

UNITED STATES PATENT OFFICE.

LEO DAFT, OF RUTHERFORD, NEW JERSEY, ASSIGNOR TO ELECTRO-CHEMICAL RUBBER & MANUFACTURING COMPANY, A CORPORATION OF NEW JERSEY.

METHOD OF ATTACHING RUBBER TO METALS.

1,057,334.

Specification of Letters Patent.

Patented Mar. 25, 1913.

No Drawing.

Application filed February 17, 1912. Serial No. 678,365.

To all whom it may concern:

Be it known that I, LEO DAFT, a subject of the King of Great Britain, and a resident of Rutherford, in the county of Bergen, State of New Jersey, have invented a new and Improved Method of Attaching Rubber to Metals, of which the following is a specification.

My invention relates to a method of attaching rubber to metals by direct vulcanization of the rubber upon the surface of the metal, so as to produce a chemical combination between the constituents of the rubber and of the metal to which it is attached.

I have described in my application filed concurrently herewith, Serial No. 678,364 a method of attaching rubber to metals provided the metal contains bismuth or bismuth and arsenic; and I have there also described a method of electroplating the surface of the metal with alloys of bismuth or bismuth and arsenic, in the event that the metal does not contain these substances. I have not, however, claimed the method therein set forth of producing the electrolyte, nor this method in combination with the method of producing the electrolyte and it is to these matters that the present application is more particularly directed.

Inasmuch as the alloy which is to be plated upon the article to which the rubber is to be attached should contain its metal constituents in certain definite proportions (which, however, may be varied according to the composition of the rubber compound), and inasmuch as it is highly desirable to obtain a deposit containing these metals in these proportions with certainty, it is very important to so proceed in the making of the electrolyte that none of its constituent elements shall be precipitated out of solution, except to the extent of the excess over the particular quantity desired. The method I prefer to accomplish these results is the following:

If the alloy which is to be plated upon the article to which the rubber is to be attached is to contain bismuth without the addition of arsenic, I first cast an alloy of copper, zinc and bismuth, in the following proportions: copper, 60 parts; zinc, 37 parts; bismuth, 3 parts. This alloy I dissolve in a strong oxidizing agent, such as hot nitric acid (specific gravity 42 Baumé). This gives a light blue, turbid fluid, which I neu-

tralize by the addition of ammonia or other similar agent, thus producing a clear dark blue solution, to which I add sufficient potassium cyanid to clear the fluid and to make the same strongly alkaline. The resulting liquid, after the addition of the potassium cyanid, is a light yellow. When, however, it is desired to include arsenic as well as bismuth in the alloy to be plated, I prefer to make an alloy of copper, zinc, bismuth and arsenic, in the following proportions: copper, 60 parts; zinc, 38 parts; bismuth, 1 part; arsenic, 1 part. This alloy is made by first fusing together the copper, zinc and bismuth, and then adding the arsenic in the form of a powder, after which the whole should be well puddled before pouring. I then proceed in the same manner as when copper, zinc and bismuth alone are used, by dissolving the alloy in hot nitric acid, adding ammonia and performing the same operations as in the previous case. The liquid produced in either case is diluted with sufficient water to form the electrolyte, at about a specific gravity of 1.040. The article to which the rubber is to be attached is then placed in the electrolyte and electroplated in any preferred manner. I prefer to use a current of about .6 amperes per square decimeter of surface to be plated, at a voltage of from $3\frac{1}{4}$ to 6 volts, but these values may be varied within wide limits. The anodes used in each case consist of the alloy described above, viz., where copper, zinc and bismuth are used in the electrolyte, the anodes are: copper, 60 parts; zinc, 37 parts; bismuth, 3 parts, and where arsenic is used as well as bismuth, the anode I prefer to use is: copper, 60 parts; zinc, 38 parts; arsenic, 1 part; bismuth, 1 part. The article thus plated is then thoroughly cleaned and is brought into contact with the rubber and vulcanized under pressure at a high temperature, say 250° to 320° Fahrenheit.

I do not intend to confine myself to the exact proportions of the various ingredients set forth above, nor to the exact method of performing the various steps of the process, nor to the identical ingredients themselves. Many, if not all, of the ingredients have well known chemical equivalents, and equivalent reactions may be obtained. It is evident that many, if not all of these things may be varied within relatively wide

limits without departing from the spirit of my invention.

What I claim and desire to procure by Letters Patent is:

5 1. The method of attaching rubber to metals which consists in electroplating the article to which it is desired to attach the rubber in an electrolyte made from a plurality of metals one of which is bismuth, 10 obtaining a deposit containing bismuth, and attaching the rubber to the surface thus formed, by vulcanization.

2. The method of attaching rubber to metals which consists in electroplating the 15 article to which it is desired to attach the rubber in an electrolyte made from a plurality of metals two of which are bismuth and copper, obtaining a deposit containing bismuth and copper, and attaching the rubber to the surface thus formed, by vulcanization.

3. The method of attaching rubber to metals which consists in electroplating the article to which it is desired to attach the 25 rubber in an electrolyte made from a plurality of metals three of which are bismuth, copper and zinc, obtaining a deposit containing bismuth, copper and zinc, and attaching the rubber to the surface thus 30 formed, by vulcanization.

4. The method of attaching rubber to metals which consists in electroplating the article to which it is desired to attach the rubber, in an electrolyte made from a plurality of metals two of which are bismuth 35 and arsenic obtaining a deposit containing bismuth and arsenic, and attaching the rubber to the surface thus formed, by vulcanization.

5. The method of attaching rubber to metals which consists in electroplating the article to which it is desired to attach the rubber in an electrolyte made from a plurality of metals three of which are bismuth, 45 arsenic and copper, obtaining a deposit containing bismuth, arsenic and copper, and attaching the rubber to the surface thus formed, by vulcanization.

6. The method of attaching rubber to 50 metals which consists in electroplating the article to which it is desired to attach the rubber in an electrolyte made from a plurality of metals four of which are bismuth, arsenic, copper and zinc, obtaining a deposit 55 containing bismuth, arsenic, copper and zinc,

and attaching the rubber to the surface thus formed, by vulcanization.

7. The method of attaching rubber to metals, which consists in electroplating the article to which it is desired to attach the 60 rubber in an electrolyte made from a cast alloy containing bismuth, obtaining a deposit of said alloy and vulcanizing the rubber directly upon the surface thus produced.

8. The method of attaching rubber to 65 metals which consists in electroplating the article to which it is desired to attach the rubber in an electrolyte made from a cast alloy containing bismuth and copper, obtaining a deposit of said alloy and vulcanizing the rubber directly upon the surface 70 thus produced.

9. The method of attaching rubber to metals which consists in electroplating the article to which it is desired to attach the 75 rubber in an electrolyte made from a cast alloy containing bismuth, copper and zinc, obtaining a deposit of said alloy and vulcanizing the rubber directly upon the surface thus produced.

10. The method of attaching rubber to metals which consists in electroplating the article to which it is desired to attach the rubber in an electrolyte made from a cast 80 alloy containing bismuth and arsenic, obtaining a deposit of said alloy and vulcanizing the rubber directly upon the surface thus produced.

11. The method of attaching rubber to metals which consists in electroplating the 90 article to which it is desired to attach the rubber in an electrolyte made from a cast alloy containing bismuth, arsenic and copper, obtaining a deposit of said alloy and vulcanizing the rubber directly upon the 95 surface thus produced.

12. The method of attaching rubber to metals which consists in electroplating the article to which it is desired to attach the rubber in an electrolyte made from a cast 100 alloy containing bismuth, arsenic, copper and zinc, obtaining a deposit of said alloy and vulcanizing the rubber directly upon the surface thus produced.

In witness whereof I have hereunto signed 1 my name in the presence of two witnesses.

LEO DAFT.

Witnesses:

WALTER S. JONES,

MARGARET MACINTYRE.